SOIL SAMPLING AND ANALYSIS WORK PLAN

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INCORPORATED

SOIL SAMPLING AND ANALYSIS WORK PLAN

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1.0 INTRODUCTION

This Soil Sampling and Analysis Work Plan describes a field investigation to be implemented by Hecla Mining Co. (Hecla) at a lined waste impoundment (referred to as Pond 2) located at the Apex site in Washington County, Utah. This work plan has been prepared for Hecla by Shepherd Miller, Inc. (SMI).

1.1 EPA Order and Work Plans

Hecla received from EPA Region VIII, the *Order Requiring Monitoring, Testing, Analysis and Reporting issued pursuant to Section 3013 of RCRA, 42 U.S.C. § 6934, for the Hecla Pond, Shivwits Band Paiute Reservation, Washington County, Utah,* dated September 22, 1999 (the Order) (EPA, 1999), subsequent to an EPA RCRA compliance evaluation inspection conducted at Pond 2 in November 1998. The Order required that Hecla prepare two documents: (1) a soil sampling and analysis work plan, and (2) a leachate and runoff sampling and analysis work plan.

The two work plans were originally prepared in January 2000 to comply with the September 22, 1999 RCRA Order. The work plans were modified in September 2000 to address EPA comments on earlier versions of the plans (EPA, 2000a, 2000b). This plan is an update of the previous versions of the work plans, reflecting discussions with EPA Region VIII personnel in Denver on June 7, 2001.

1.2 Site Background

Pond 2 was used from approximately 1984 to 1995 for disposal of mineral beneficiation waste, waste from cobalt sulfate recovery operations and soil, liner materials, and sediment from site cleanup operations. Pond 2 is synthetically-lined, approximately 500 feet in diameter and 15 feet deep. Pond 2 and the immediately surrounding area are fenced and encompass approximately eight acres. The Pond 2 liner was professionally installed and supervised, and is comprised of a textile reinforced spray-on asphaltic membrane. The thickness of the membrane is approximately one-quarter to one-half inches.

As described in SRK (1989) the site is underlain by up to 30 feet of silty sand soils of aeolian and colluvial origin. Beneath these soils are a sequence of sandstones, siltstones and limestones (within the Triassic Moenkopi Formation) several hundred feet thick. Groundwater has been found in these fractured sedimentary rocks at a depth of 160 to 300 feet (SRK, 1984; Kleinfelder, 1995). The groundwater present in the fractured sedimentary rocks comprises the uppermost aquifer beneath the site, and provides makeup water for the operations at the site. Static water levels measured in groundwater characterization wells (installed in 1983) show a gradient for groundwater flow from south to north.

As described in SRK (1989), surface water drainage in the site area is from south to north. Runoff flows toward the Pond 2 area from the south, but is conveyed around Pond 2 by a diversion channel. Runoff from the Pond 2 area flows to the north, into a gravel pit excavated in the natural drainage.

1.3 Operational Background

In 1984, the St. George Mining Company leased approximately 180 acres from the Shivwits Band of Paiute Indian Tribe and constructed a mill for extraction of gallium and germanium from copper ore from the nearby Apex Mine. The 180-acre leased area is referred to as the Apex site. From 1984 to 1988, tailings from the gallium and germanium extraction process were discharged into Pond 2, as well as other impoundments at the site operated by St. George Mining Company.

Pond 2 was constructed with a perimeter embankment of on-site soil, with the pond bottom and inside embankment surfaces lined with a reinforced spray-on asphaltic membrane of one-quarter to one-half inch thickness. Several of the other ponds on site were constructed in the same manner using the same contractor and construction quality assurance procedures (SRK, 1989). At the end of St. George Mining Company's operation, there were seven synthetically-lined ponds containing various amounts of solutions and solids from the gallium and germanium extraction process (Ponds 1A, 1C, 3A, 3B, 2A, 2, and a surge pond). An additional unlined pond, designated as 1B, was not used by St. George Mining Company.

Hecla purchased the operation from St. George Mining Company in March 1989 and continued gallium and germanium extraction operation until 1990. In 1989, Hecla removed the St. George Mining Company materials from ponds 1A and 3A, placing this material in Pond 3B. Hecla re-lined Pond 3A and a combined pond 1A/B with a double HDPE liner system. During this period, the waste stream from the operation was treated with limestone and lime and sent to the re-lined ponds 1A/B and 3A in slurry form. No other ponds were used by Hecla. Following the shutdown of the gallium and germanium operation in 1990, Hecla operated a cobalt-sulfate recovery process at the Apex site until September 1995. This operation included disposal of certain non-hazardous wastes in pond 1A/B and 3A. The St. George Mining Company materials in Ponds 1C, 2A, and 3B were removed by Hecla and placed into Pond 2 between 1990 and 1995. These materials were generally mixed with limestone at the time of relocation.

In 1995, Hecla sold the operation to OMG Americas, Inc. (OMG), with the exception of the Pond 2 area, which was retained by Hecla. OMG continues to operate a cobalt recovery process at the site. Hecla entered into an Amendment to Lease with the Shivwits Band of Paiutes on September 25, 1995, to lease approximately eight acres of the original site (which incorporates Pond 2).

1.4 Pond 2 Closure

As part of the Purchase and Sale agreement with OMG, Hecla removed materials in and below the ore stockpile area and ponds at the site in accordance with soil cleanup standards established by Hecla and OMG. Hecla disposed of these materials in Pond 2. The excavated materials from the ore stockpile area were placed in the south end of Pond 2. The materials within Ponds 1 A/B were trucked to Pond 2 and dumped from either the pond perimeter or the ore pad fill area. Pond liner materials and subsoils were excavated and trucked to Pond 2 for disposal. The materials within Ponds 3A were dredged and pumped as a slurry to Pond 2. Estimated volumes produced during Hecla operation and site cleanup are listed in the Order, based on Hecla data.

As part of the site cleanup work, the perimeter embankment of Pond 2 was raised approximately five feet to provide sufficient capacity for material disposal. The embankment raise was accomplished by placing soils over the centerline of the original embankment.

Currently, Pond 2 is covered, with the perimeter of the leased area fenced. Following site cleanup work, the impoundment surface was leveled and preliminarily covered in a dome-shaped configuration using off-site borrow material. The cover is a combination of rock and topsoil, averaging approximately three feet in thickness. The maximum material thickness beneath the cover is estimated to be approximately 15 feet. A diversion ditch collects run-on from the south and east and conveys this flow around the east side of Pond 2 and into the excavated gravel pit north of Pond 2 on OMG property.

1.5 Seepage Mitigation

Seepage was first observed by Hecla in 1997 on the southwest side of Pond 2. This seepage was from porewater that had migrated through the perimeter embankment raise that was constructed for site cleanup operations. In order to intercept this seepage, Hecla constructed a synthetically-lined ditch that flows to a synthetically-lined evaporation pond on the southwest side of Pond 2.

In 1997, Hecla observed an additional moist area on the east side of Pond 2. There was insufficient seepage to collect, so no interception work was done, and this area has dried out since 1997.

In November 1998, Hecla constructed a second evaporation pond (Evaporation Pond 2) to increase the holding and evaporation capacity of the seepage water from the southeast corner of Pond 2. At the same time a berm and ditch were constructed to divert up-gradient stormwater runoff from collecting in the evaporation pond area. During the summer of 1999, water from the existing evaporation pond (Evaporation Pond 1) was transferred via a portable pump to the newly constructed Evaporation Pond 2.

Hecla made additional modifications to the evaporation pond system in January 2000. Hecla transferred the material, water, and liner from Evaporation Pond 2 into a pit excavated through the top of Pond 2. The Evaporation Pond 2 area was then backfilled with borrow material. The channel to Evaporation Pond 1 was also excavated, and the material placed into the pit in Pond 2. The pit was then covered and leveled. A new, wider collection ditch (approximately 5 feet wide, 80 feet long, and 1 foot deep) was constructed as well as a new evaporation pond (Evaporation

Pond 3), parallel to the edge of Pond 2. Evaporation Ponds 2 and 3 (located at the southwest corner of Pond 2), were lined with UV-resistant polyvinyl chloride (PVC) material.

The evaporation system was re-lined in March 2001 using MDPE. The size of both ponds was increased as a result of the old liner excavation. Also, the side walls were sloped to improve liner wear and decrease the chance of tears. The ditch between the ponds was reshaped to serve as an overflow ditch.

At this time the system nomenclature and labeling was modified to more accurately reflect the system use. Evaporation pond 3 was renamed collection pond 1. The current dimensions are:

- seepage collection ditch: 5 feet wide, 35 feet long and 1 foot deep
- collection pond 1: 10 feet wide, 80 feet long and 5 feet deep
- overflow ditch: 8 feet wide, 50 feet long and 1 foot deep
- evaporation pond 2: 12 feet wide, 85 feet long and 4 feet deep

2.0 SOIL SAMPLING AND ANALYSIS

2.1 Objective

Based on discussions with EPA on June 7, 2001, the specific objective of this work plan is to assess the extent of and potential for seepage migration from Pond 2 by evaluation of key physical conditions inside and outside of Pond 2. A single drilling and sampling event is anticipated to achieve this specific objective.

All sampling activities will be performed in a manner consistent with applicable portions of EPA Region VIII's Field Sampling Guide (EPA, 1996), the QA/R-5 (EPA, 1998), and EPA SW-846 (EPA, 1986). Quality assurance methods are described in the Quality Assurance Project Plan (QAPP) included as Attachment A to this document. A health and safety plan (HASP) prepared for this program is included as Attachment B to this document, which presents the human health and safety requirements and guidelines for performance of the work.

2.2 Drilling Locations

Two locations for drilling and sampling are proposed within Hecla leased property: (1) within Pond 2, and (2) the area of observed seepage outside the perimeter of Pond 2. These locations were selected based on discussions with EPA on June 7, 2001, and are described below.

Area within Pond 2. The purpose of drilling and sampling within Pond 2 is to evaluate the physical conditions of the waste materials present. These physical conditions (specifically degree of saturation and density) would be used to assess: (1) the potential for seepage migration through the liner and (2) the degree of consolidation of waste materials present in Pond 2.

The materials in Pond 2 are listed below in order of placement.

1. Tailings from St. George Mining Company and Hecla gallium/germanium recovery operations (discharged as a slurry).
2. Lime-neutralized waste and liner materials excavated by Hecla from cleanup of other ponds at the site (placed in Pond 2 with earthmoving equipment).

3. Residual ore and underlying subsoils from Hecla cleanup of the ore stockpile area (placed in Pond 2 with earthmoving equipment).

4. Soils from site cleanup (placed in Pond 2 with earthmoving equipment).

5. Liquids and sediments from cleanup of Pond 3A (discharged as a slurry).

6. Native soils from nearby borrow areas used for cover material (placed on top of Pond 2 with earthmoving equipment).

Drilling and sampling within Pond 2 will be conducted to evaluate the moisture and density conditions of these materials. However, this will be done in a manner that does not damage or penetrate the existing liner.

Area of observed seepage outside the perimeter of Pond 2. The purpose of sampling in the area of observed seepage near the southwest corner of Pond 2 is to evaluate the physical conditions of the subsoils (specifically degree of saturation). This information would be used to assess the extent of seepage migration with depth into the subsoils. The proposed drilling and sampling location is adjacent to the existing evaporation ponds.

2.3 Drilling and Sampling

The proposed program consists of drilling one hole in each of the two areas with a drilling rig. A standard, truck-mounted geotechnical drilling rig will be used with hollowstem augers for advancing and temporary casing the hole. A dry-core sampler would be the first choice in collecting samples on a continuous basis. A split-spoon sampler would be the second choice for obtaining samples at discreet intervals (if the dry-core sampler is not successful). Sampling will be supplemented by detailed logging of the drilled profile, conducted by a certified engineer or geologist. Drilling in the two areas is described below.

Auger hole within Pond 2. The location of the auger hole within Pond 2 will be near the center of the pond. The depth of drilling will be limited to roughly 10 feet, or within five feet above the existing liner. If more detailed information on the elevation of the existing synthetic liner is available, drilling to a depth closer to the liner may be conducted.

Auger hole outside of Pond 2. The location of the auger hole outside of Pond 2 will be adjacent to the existing evaporation ponds. The depth of drilling will be roughly 30 feet, or through the contact between surficial soils and underlying sedimentary rock. If materials at this geologic contact show a high degree of saturation, drilling 5 to 10 feet into the sedimentary units may be done (if possible).

Based on the field observations from drilling the auger hole outside of Pond 2, additional auger holes may be drilled outside of Pond 2 in potential areas of seepage, as agreed jointly between Hecla and EPA personnel on site.

Soil and other solid material samples will be collected according to methods described for soil sampling in Standard Operating Procedure (SOP) No. 3. Additionally, procedures described for decontamination in SOP No. 4 will be used. Procedures for sample handling, documentation and analysis described in SOP No. 5 will be used during sampling. These SOPs are included in Attachment C to this work plan.

The auger holes will be backfilled after completion of logging and sampling, and closed in accordance with applicable requirements from the Utah State Engineer's Office. Any exposed waste will be backfilled in the auger hole beneath the depth of the soil cover on Pond 2.

2.4 Decontamination

Decontamination procedures are described in SOP No. 4, and are summarized below.

Drilling equipment (hollowstem augers, auger bits, and drilling rods) in contact with waste materials but not in contact with samples will be decontaminated prior to leaving the site. Because sampling is to be conducted within drilling augers, the inside auger surfaces will not be in contact with materials to be collected for sample analysis and decontamination of augers between holes is not necessary.

Sampling equipment (drilling samplers, hand augers, and other sampling tools) in contact with samples will be decontaminated after each use.

Decontamination will be conducted by pressurized steam cleaning or by hand washing (with a decontamination solution) and rinsing. The primary decontamination area will be a synthetically-lined area near the evaporation ponds, where decontamination water can be collected and conveyed to the evaporation ponds. The secondary decontamination area will be an excavated or formed area within the cover on top of Pond 2, where decontamination water can be collected and allowed to infiltrate into the Pond 2 materials.

2.5 Sample Testing

All of the collected samples will be logged, with specific samples selected for laboratory analysis by Hecla and EPA field personnel. If requested, sample splits will be provided to EPA (or other parties) in the field at the time of sample collection.

Solid material samples will be tested according to applicable ASTM methods, or other methods satisfactory to EPA (such as EPA, 1986 if applicable). The laboratory will be selected based on joint agreement between Hecla and EPA personnel. The anticipated tests will include natural dry density and moisture content, specific gravity of solids, and consolidation. Preliminary measurements of natural wet density will be made on site.

2.6 Quality Assurance

Where applicable, sampling activities will be performed in a manner consistent with EPA Region VIII's Field Sampling Guide, and the QA/R-5 (EPA, 1996, 1998) as well as EPA (1986). Quality assurance methods are described in the Quality Assurance Project Plan (QAPP) included as Attachment A to this work plan.

3.0 SCHEDULE

According to Paragraph No. 70 of the EPA Order, Hecla is required to implement the work plan within 10 days following EPA approval (or approval with modification) of the work plan. Implementation of the work plan will include final contracting and scheduling of the drilling or excavation subcontractors. Hecla will notify the EPA, Tribal and BIA representatives identified in Paragraph Nos. 65 and 66 of the Order in writing within 10 calendar days before engaging in any field activities at the Apex site. Hecla will submit a final report to the EPA within 45 days of work completion.

4.0 REFERENCES

Kleinfelder, Inc. (1995). "Apex Unit Water Well Pump and Recovery Tests," prepared for Hecla Mining Company, July 14.

Steffen, Robertson and Kirsten (SRK), 1984. "Groundwater Supply Availability for the Apex Project, Washington County, Utah," prepared for St. George Mining Company, May.

Steffen, Robertson and Kirsten (SRK), 1989. "Preliminary Process Design for Treatment and Neutralization of Existing Solid and Liquid Wastes at the Apex Mine," prepared for Hecla Mining Company, February.

U.S. Environmental Protection Agency (EPA), 1986. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. EPA SW-846*, September.

U.S. Environmental Protection Agency (EPA), 1996. *EPA Region VIII Minimum Requirements for Field Sampling Activities,* U.S. Environmental Protection Agency, Technical and Management Services, Denver, Colorado, September.

U.S. Environmental Protection Agency (EPA), 1998. *EPA Requirements for Quality Assurance Project Plans for Environmental Data Operation. QA/R-5,* U.S. Environmental Protection Agency Quality Assurance Division, External Review Draft Final, October.

U.S. Environmental Protection Agency (EPA), 1999. Order Requiring Monitoring, Testing, Analysis and Reporting. United States Environmental Protection Agency, Region VIII. RCRA Docket. Proceeding Under Section 3013 of the Resource Conservation and Recovery Act, 42 U.S.C. § 6934, Docket No.: RCRA-8-99-06, September.

U.S. Environmental Protection Agency (EPA), 2000a. Letter Concerning Comments on Soil Sampling and Analysis Work Plan and Leachate and Run-Off Sampling and Analysis Work Plan, addressed to Hecla Mining Company, August 2.

U.S. Environmental Protection Agency (EPA), 2000b. Letter Concerning Comments on Soil Sampling and Analysis Work Plan and Leachate and Run-Off Sampling and Analysis Work Plan, addressed to Davis Graham and Stubbs, November 3.

ATTACHMENT A

QUALITY ASSURANCE PROJECT PLAN

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

QUALITY ASSURANCE PROJECT PLAN

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A.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared as an attachment to the Soil Sampling and Analysis Work Plan for the Hecla Mining Company (Hecla) Apex Unit, prepared in response to the RCRA Order issued to Hecla in September 1999 by EPA Region VIII (EPA, 1999). The QAPP is a planning document for environmental data collection, analysis and reporting activities. The QAPP documents how environmental data operations are planned, implemented, and assessed. The QAPP will define how specific quality assurance (QA) and quality control (QC) activities will be applied during the project. The following elements of the Apex site QAPP follow the format required by EPA Region VIII and specified in EPA QA/R-5, (EPA, 1998a).

A.2 PROJECT MANAGEMENT

This section of the QAPP deals with project history and objectives, and roles and responsibilities of personnel assigned to the project. This section ensures that a project goal is defined, that participants understand the goal, that participants are assigned to tasks, and that approaches to be used and planning outputs have been documented.

A.2.1 Project Organization

Responsibilities of Personnel. The sampling and analysis plans will be implemented by Hecla personnel. The key personnel will be identified prior to initiation of the Work Plan. The assigned responsibilities of key personnel for conducting the Work Plan are outlined below.

<u>Project Manager.</u> The project manager has overall responsibility for all Hecla activities on the project. The project manager has the responsibility for establishing the QAPP, for monitoring the quality of the technical and managerial aspects of the project, and for implementing the QAPP and corrective measures, where necessary.

<u>Project Engineer/QA/QC Officer.</u> The Project Engineer/QA/QC Officer reports to the project manager and works directly with other project personnel. The QA/QC Officer has the responsibility to monitor and verify that the work is performed in accordance with this plan, the Standard Operating Procedures (SOPs), and other applicable procedures. The QA/QC Officer also has the responsibility to assess the effectiveness of the QA program and to recommend modifications to the program when applicable. The Project Engineer/QA/QC Officer is responsible for assuring that the personnel assigned to the project are trained for the requirements of the QA program. He is also responsible for reviewing and verifying the disposition of nonconformance and corrective action reports, and for periodic quality assurance audits. The QA/QC Officer will advise the project manager and is responsible for implementing the QA program related to assigned tasks.

Qualifications of Personnel. All personnel assigned to this project, including employees and consultants, will be qualified to perform the tasks to which they are assigned.

A.2.2 Background and Site Description

The Apex site (site) is located near St. George, Utah in Section 5, Township 42 South, Range 17 West in Washington County. The site is on the reservation of the Shivwits Band of the Paiute Indian Tribe. The site includes a 500-foot diameter tailings impoundment and adjacent lined ponds used for collection and evaporation of runoff and seepage, if any. The tailings impoundment has historically been referred to as Pond 2. Additional site background and description is included in the Work Plan.

A.2.3 Project Objectives

The objective of the soil sampling program is to collect, analyze, and report the nature and extent of potential soil contamination from seepage in and around the Pond 2 site. The objective of the leachate and runoff sampling program is to characterize the nature of contamination in those media. The purpose of the QAPP is to ensure achievement of the project objectives by defining specific QA and QC activities to assure the quality of the collection and analysis procedures.

A.2.4 Project/Task Description

The program will consist of sampling of soil and other solid materials. The soil sampling will be conducted by drilling. Further description of the schedule, specific locations, depths, and methods of sample collection and analyses are included in the work plans.

A.2.5 Data Quality Objectives for Measurement Data

The measurements collected at the site and samples taken from the site are intended to provide the information necessary to support project objectives. The data quality will be consistent with the data quality objectives set forth in EPA's Data Quality Objectives Process (EPA, 1998b). Laboratory data quality objectives are described and defined by the EPA Contract Laboratory Program (CLP) Statement of Work (EPA, 1988a), and in the individual methods for some non-CLP parameters.

A.3 MEASUREMENT/DATA ACQUISITION

A.3.1 Sampling Process Design

The program will consist of soil sampling as outlined in Section A.2.4. Further description of the schedule, specific locations, depths, and methods of sample collection are included in the Work Plan.

A.3.2 Sampling Methods Requirements

Water samples (if collected) will be collected in accordance with procedures described in SOP No. 1. Soil and other solids samples will be collected in accordance with procedures described in SOP No. 3. Decontamination procedures as described in SOP No. 4 will be implemented on an as-needed basis. The SOPs are included in Attachment C of this document.

A.3.3 Sample Handling and Custody Requirements

Sample handling and Chain of Custody requirements are described in SOP No. 5. Water and soil samples will be collected and placed in appropriate containers in the field. Each sample will be labeled with a sample control number, location, collection time and date, sample matrix, sampler's name, and any preservation method.

Samples selected for analysis will be placed in containers and shipped to the laboratory. A Chain of Custody (COC) record form listing sample control numbers, collection times and dates, sample matrix, and sender's relinquishment signature for the samples will be included with each shipment. A copy of completed COC forms will be retained for the sampler's records; the lab will date and sign the COC upon receipt of each cooler of samples. Copies of the COCs will be included in the final data reports.

A.3.4 Analytical Methods Requirements

Table 1 in SOP No. 5 lists the applicable holding times for the various analytes. For results to be valid, analyses must be conducted prior to the expiration of the applicable holding time periods.

A.3.5 Quality Control Requirements

A.3.5.1 Internal Quality Control Checks

Internal quality control checks will be used in the evaluation of the data quality objectives. The purpose of the QC activities is to provide methods for checking, verifying, or quantifying the quality of an item or piece of data against established standards. The term "internal" applies to QC activities that are initiated internally by Hecla, its consultants, or the laboratory. Project-specific QC checks may be performed by Hecla using the field QC samples described below. The laboratory will follow EPA approved QA/QC procedures. As part of their routine sample analysis procedures, QC checks may be performed as specified in the laboratory procedures referenced in Table 1 in the work plan and described in the laboratory's QA plan.

A.3.5.2 Field Quality Control Checks

If liquid samples are collected, field QC methods related to chemical data include blank and duplicate water samples, or equipment rinsate samples. QC related to field measuring equipment may include calibration procedures and the use of standards. The QC methods for documentation may include routine checking of field books or forms, required checking and sign-off on COC forms, and checks of sampling activities for conformance to procedures.

QC checks related to documentation and calibration are described in the SOPs. The results of QC sampling will be reported as described below. Field QC samples (for liquid sampling) are outlined below.

<u>Field Duplicate Samples</u> are samples that have been divided into two or more portions at some step in the measurement and collection process. Each portion is then carried through the remaining steps in the measurement process. An example of a field duplicate sample is a water sample that has been collected and poured into two sets of sample containers in the field. Truly equivalent field duplicate samples of soil or other solid materials cannot be collected in the field due to the naturally heterogeneous nature of these solid media.

Equipment Rinsate Samples are defined as aqueous samples obtained by running analyte-free de-ionized water over sample collection equipment (dipper, auger, spatula, etc.) after these equipment have been decontaminated. The rinsate is placed in appropriate sample containers for analysis for the same parameters as samples taken with that equipment. The analytical results from these samples will be used to determine the effectiveness of decontamination procedures.

Field Blank Samples are analyte-free de-ionized water samples collected in the field at a sampling site. The blank sample then undergoes the same remaining steps of the measurement process as all other water samples. The field blank sample is analyzed for the same suite of analyte parameters as the samples being collected with that blank.

A.3.5.3 Laboratory Quality Control Checks

For liquid samples, laboratory quality control checks will include the use of blank, spike, split, and surrogate samples, instrument calibration checks, and internal standards as specified in the laboratory procedures referenced in the work plans and described in the laboratory's QA plan.

A.3.5.4 QC Sample Frequency

A field duplicate will be collected at the rate of 1 for every 20 water samples. A field blank will be collected at the rate of 1 for every 20 water samples. A field rinsate will be collected at the rate of 1 for every 20 water samples. A field rinsate will be collected at the rate of 1 for every 20 soil or other solids samples. Collection of field blanks is not applicable to the collection of soil or other solids samples.

If less than 20 samples of each media are collected, a minimum of one field duplicate, one field blank, and one field rinsate will be collected for the liquid media samples, and a minimum of one field rinsate will be collected for the solid media samples.

A.3.6 Instrument/Equipment Calibration and Frequency

Field instrument and equipment calibration and frequency are described in SOP No. 1. Field conductivity, temperature and pH meters will be calibrated daily or more frequently as required by field conditions. Instrument and equipment testing, inspection, and maintenance will follow manufacturers' recommended procedures. Field conductivity, temperature and pH meters will be inspected and tested daily or more frequently as required by field conditions. Field conductivity, temperature and pH probes will be cleaned and decontaminated between measurements; damaged or inoperative probes will be replaced as needed.

Laboratory instrumentation will be calibrated as specified in the laboratory procedures referenced in Table 1 of the work plan, in applicable SOPs, and in the laboratory QA plan.

A.4 ASSESSMENT AND RESPONSE ACTIONS

A.4.1 Assessment

The Apex site sampling program is planned as a one-time sampling event. Auditing is not anticipated beyond the internal quality assurance activities described in Section A.3.

A.4.2 Response Actions

The project schedule is provided in the work plan. Data validation will begin upon receipt of final analytical results from the laboratory. The final report for the project will include documentation of field parameters, laboratory reports, data validation reports and relevant figures and tables.

A.5 DATA VALIDATION AND USABILITY

A.5.1 Data Review, Validation, and Verification Requirements

The data generated from the site and samples taken from the site are intended to provide the information necessary to support the program objectives. The data quality objectives for quantifiable data are expressed in terms of accuracy, precision, completeness, comparability, and representativeness. Data having these characteristics are considered valid for use in achieving the program objectives.

A.5.2 Validation and Verification Methods

This section describes the data review, validation and verification process for this program. In order for the data generated from the site to provide the information necessary to support the program objectives, the data must be reviewed for completeness and representativeness.

A.5.2.1 Data Receipt and Deliverables Check

The purpose of this step is to start the data validation process. A checklist or other bookkeeping method will be used to record and verify that necessary items have been included in the analytical data reports provided by the laboratory(s). These items include the following:

- Cover page with report date, laboratory letterhead, laboratory manager sign-off
- Laboratory narrative report
- Sample identification numbers
- Sample analysis dates
- Sample media description
- Analyte list completeness
- Chain of Custody sheets
- Analyte concentration units

- Method detection limits
- Non-detect notation codes.

A.5.2.2 Data Validation

The purpose of data validation is to assess data quality using information such as holding times, instrument calibration results, and laboratory QC results. The step-by-step validation procedure is described in SOP No. 6. The following topics, sub-divided into activities performed by the laboratory or by Hecla, are addressed in validation of each data package:

Hecla Data Validation:

- Preliminary review and completeness check
- Holding times from date of sampling to date of analysis are specified in Table 1 in SOP No. 5
- Assessment of analysis results for blank samples
- Calculation of relative percent differences (RPD) for field split/duplicate sample analyses
- Check of analyte concentration calculations and reporting
- Overall data quality assessment.

Laboratory Data Validation:

- Preliminary review and completeness check
- Holding times from date of sampling to date of analysis are specified in Table 1 in SOP No. 5.
- Instrument calibration data
- Assessment of analysis results for laboratory blank samples
- Interference check sample (ICS) data for analysis by inductively coupled plasma (ICP method)
- Review of laboratory control sample results

- Calculation of relative percent differences (RPD) for laboratory split/duplicate sample analyses
- Calculation of percent recovery for matrix spike analyses
- Review of QC associated with graphite furnace atomic adsorption analyses (GFAA)
- Review of ICP serial dilution data including percent difference calculations
- Check of analyte concentration calculations and reporting
- Overall data quality assessment performed internally by the laboratory.

A.5.2.3 Data Qualification

After performing the validation steps outlined in the previous section, some of the analytical data may fail to meet the acceptance criteria. Such data may have to be qualified as estimated, or non-detect using letter codes. In some cases, data may be rejected as unusable. Data qualified as a result of data validation will be identified in a data validation report; the unqualified data reports provided by the laboratory will be included in the data validation report.

A.5.2.4 Lab Clarification

Missing information or unusual or unacceptable results will be brought to the attention of the laboratory. If problems are identified (e.g., invalid data or missing data), transmittal of the data will be postponed until the problems are rectified. When analytical results are changed by the laboratory, the new laboratory report sheets will replace the invalid former analytical reports and the former data sheets will be discarded.

A.5.2.5 Data Entry and Management

Spreadsheets or a relational database may be constructed to electronically store the data for future access and use. The stored data will be labeled with unique identifying designations to ensure capture of essential information including sampling date, sample location, analyte concentration, units, and other sample specific parameters.

A.5.2.6 Assessment of Accuracy and Precision

The data validation process described in the previous sections produces an assessment of accuracy and precision through comparison of field and laboratory QC samples and methods. This assessment will be performed on each data package to ensure consistency of the data.

A.5.3 Reconciliation with Data Quality Objectives

The measurements taken and samples collected at the site are intended to provide the information necessary to support the program objectives. Following data validation, the resulting data will be compared to the data quality objectives. A written assessment of the degree to which the objectives have been met will be documented as part of the final report.

A.6 REFERENCES

U.S. Environmental Protection Agency (EPA), 1999. Order Requiring Monitoring, Testing, Analysis and Reporting. United States Environmental Protection Agency, Region VIII. RCRA Docket. Proceeding Under Section 3013 of the Resource Conservation and Recovery Act, 42 U.S.C. § 6934. Docket No.: RCRA-8-99-06. September.

U.S. Environmental Protection Agency (EPA), 1998a. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operation. QA/R-5. U.S. Environmental Protection Agency Quality Assurance Division. External Review Draft Final. October.

U.S. Environmental Protection Agency (EPA), 1998b. EPA Guidance for Quality Assurance Project. EPA QA/G-5. February.

ATTACHMENT B

HEALTH AND SAFETY PLAN

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

HEALTH AND SAFETY PLAN

TABLE OF CONTENTS

LIST OF SUPPLEMENTS

B.1 ADMINISTRATIVE INFORMATION

Pursuant to the Soil Sampling and Analysis Work Plan for the Hecla Apex Unit, this Health and Safety Plan (HASP) presents the human health and safety requirements and guidelines for performance of work conducted. This HASP covers only those work activities necessary to complete the Work Plan. The specific work activities are described in the Work Plan.

B.1.1 Health and Safety Plan Scope

The work covered by this HASP will be conducted by Hecla Mining Company (Hecla) and its contractors and their subcontractors. Company personnel, contractors and subcontractors, and all engaged in performance of work plan-related activities at and near the site shall comply with all provisions of this HASP.

Hecla cannot anticipate all the hazards inherent to the work activities of all of its contractors and subcontractors. Therefore, each contractor and subcontractor will be required to read and evaluate this HASP to ensure that it adequately addresses the hazards presented to their employees. This HASP presents the minimum requirements for all contractors and subcontractors. Addenda may be attached to the plan to ensure that potential risks are controlled for all site tasks. In addition, no portion of this plan will be used without the express permission of Hecla.

This HASP was prepared using the *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities* (NIOSH, 1985). This plan is in compliance with 29 CFR 1910.120 and 1910.1200 and was prepared for the exclusive use of Hecla and its contractors and subcontractors. This plan shall not be used for work other than that described in the Work Plan, nor shall it be modified or used without written approval of Hecla. In addition, this plan shall not be used by firms or persons who are not under contract with Hecla.

B.1.2 Responsibilities of Project Manager

The Hecla project manager has overall responsibility to assure that work performed pursuant to the Work Plan complies with the health and safety requirements and guidelines of this HASP.

The Hecla project manager will be identified prior to initiation of the Work Plan (phone number 208-769-4100).

The responsibilities of the project manager are as follows:

- Overall responsibility for all aspects of work at and near the site, including compliance with this HASP
- Monitoring the quality of the technical and managerial aspects of the project.

The project manager has the authority (safety-related) to:

- Take actions necessary to ensure that the staff are technically and professionally qualified, have obtained the required safety training, have adequate relevant experience, and represent sufficient resources to meet project health and safety objectives
- Assign a Site Safety Officer to the project and, if necessary, assign a suitably qualified replacement
- Conduct or causing to be conducted appropriate reviews to ensure that the HASP is properly implemented
- Implement corrective measures if and where appropriate.

B.1.3 Responsibilities of Site Safety Officer/Project Engineer

The Site Safety Officer/Project Engineer for work performed under this HASP will be identified prior to initiation of the Work Plan (phone number 208-769-4100).

The responsibilities of the Site Safety Officer/Project Engineer are:

- Directing health and safety related activities, such as safety meetings
- Reporting all safety-related incidents or accidents immediately to the Project Coordinator
- Assisting in all aspects of implementing the HASP
- Maintaining health and safety equipment
- Implementing emergency procedures as required

- Evaluating the effectiveness of the HASP and reporting deficiencies as needed
- Enforcing the buddy system to maintain communication between workers
- Maintaining a health and safety log as outlined in Section B.3.9 of this HASP
- Maintaining records of HASP compliance agreements for all staff and contractors
- Conducting safety meetings as required
- Defining limited access zones (based on potential hazards) on a task-by-task basis
- Monitoring personnel for signs of stress, such as cold exposure, heat stress, and fatigue.

The Site Safety Officer/Project Engineer has authority to:

- Suspend work or otherwise limit exposure to personnel if health and safety conditions appear to be unsuitable or inadequate
- Suspend personnel or subcontractors from field activities for infractions of the health and safety plan, pending an evaluation by the project manager.

B.2 SITE DESCRIPTION AND BACKGROUND

The Hecla Apex Unit is an inactive tailings impoundment (historically referred to as Pond 2) on property leased by Hecla from the Shivwits Band of the Paiute Indian Reservation northwest of St. George, Utah, in Washington County. Pond 2 is approximately 500 feet in diameter and has an earthen embankment with a maximum height of approximately 15 feet. Pond 2 and the immediately surrounding area encompass approximately eight acres and is within an approximately 180 acre site that is currently being operated by OMG Americas as a cobalt recovery facility. Pond 2 was used for disposal of mineral beneficiation waste and waste from a cobalt-sulfate operation. Additional site and Pond 2 information is provided in Section 1 of the Work Plan.

The sampling and analysis program associated with this HASP will consist of sampling and analysis of soils (and other solids) and liquids within the perimeter of Pond 2 as well as areas outside the perimeter of Pond 2. This program is to be conducted by Hecla in response to the September 1999 Region VIII EPA Order (EPA, 1999) and subsequent discussions with the EPA.

B.3 GENERAL HEALTH AND SAFETY REQUIREMENTS

Personal protective equipment (PPE) is used to shield or isolate individuals from chemical or physical hazards that may be encountered while performing work plan-related work at and in the vicinity of Pond 2. Although the risk of exposure to hazardous substances is very low, all work performed pursuant to the Work Plans shall be conducted with Level D PPE as specified in Section B.4.5.

Airborne dust generated during drilling operations may be a concern. If excessive dust emissions are observed, work shall be immediately halted and engineering controls (watering) implemented to reduce dust emissions.

B.3.1 Site Safety Meetings

All field personnel shall attend an initial Site Safety Meeting before commencing field work. Safety meetings shall be scheduled and conducted by the Site Safety Officer. The requirements of this HASP will be reviewed at this initial meeting, and discussion will include the following:

- Contaminants and exposure pathways of concern
- Physical hazards
- Task specific procedures
- Personal protective equipment (PPE)
- Decontamination requirements and procedures
- Emergency procedures
- Evacuation routes.

At the close of the initial Site Safety Meeting, all field employees shall sign a safety compliance form stating that they have read and understand this HASP and agree to comply with its provisions. A copy of the compliance form is presented in Supplement B1.

Subsequent safety meetings will be conducted on an as-needed basis. The Site Safety Officer will determine when work procedures have changed and when additional meetings are necessary to introduce further safety requirements.

B.3.2 Accident/Incident Reporting

If an accident or incident results in physical injury, illness, or chemical exposure, the Site Safety Officer shall report the incident in writing to the Project Manger. Emergency response is discussed in Section B.3.7.

B.3.3 Prohibited Activities

Personnel shall not do the following:

- Work alone on the site with power equipment
- Smoke, eat, or chew gum or tobacco on the site except in designated areas.

Utilizing the buddy system during activities involving power equipment will permit personnel to attend to co-workers or seek assistance should an accident or other emergency situation arise. The buddy system will also reduce the likelyhood of accidents as co-workers observe each other performing work activities. Smoking, eating, or chewing gum or tobacco increases the risk of ingestion of airborne substances and dust.

Due to competing health risks, provision will be made for clean drinking water supplies for workers at all times. The need for field personnel to remain well hydrated to avoid heat related illness supersceeds the low probability of exposure to hazardous substances.

No employee shall perform work in any area where hazardous conditions exist that would endanger the employee's safety unless visual and/or verbal contact is maintained. At the discretion of the Site Safety Officer, the buddy system may be waived for low-hazard tasks.

B.3.4 Visitor Clearance

Due to potential hazards presented at the site, Hecla will, to the extent it is able, exclude all persons other than those associated with Hecla or its contractors from Pond 2 unless authorized by Hecla and accompanied by an authorized person. Hecla will deny authorization to those persons who do not meet the training requirements of Section B.3.8 of this HASP.

Any non-authorized person seen on the site by a Hecla representative or other authorized person will be (1) informed that there are potential hazards at the site, (2) asked to leave the site, and (3) told to contact the Site Safety Officer for further information regarding access to the site.

B.3.5 Medical Surveillance

It is anticipated that medical surveillance will not be required for activities related to the Work Plans at the site.

B.3.6 Decontamination

Decontamination of personnel and equipment shall be performed in accordance with SOP No. 4 (Attachment C). Decontamination procedures for field personnel shall take place on an as-needed basis and may include:

- Washing boots with detergent solution and rinsing
- Removing coveralls (if used) and washing with detergent
- Removing hard hat and other safety equipment and washing with detergent solution and rinsing
- Removing gloves (if used)
- Washing hands, face, and forearms before eating/drinking.

Decontamination of heavy equipment (where applicable) shall take place at a designated decontamination area. Decontamination shall take place such that all wash and rinse water will be contained.

B.3.7 Emergency Response

Emergency response phone numbers are included in Supplement B2 to this HASP.

B.3.7.1 Lines of Authority

At least one employee, either at Pond 2 or on call at all times during project hours, will be available to respond to emergency situations. This Site Safety Officer has the responsibility of coordinating all emergency response measures and will be thoroughly familiar with all aspects of this HASP, the location of all records, and the work area layout.

The primary Emergency Coordinator will be identified prior to initiation of the Work Plan (phone number 208-769-4100).

B.3.7.2 Evacuation and Emergency Procedures

Due to the nature of the contaminants at the site, chemical releases requiring evacuation are not anticipated to occur. Therefore, evacuation routes have not been established. However, all exits will be identified to all employees during the initial Site Safety Meeting. The Site Safety Officer is responsible for updating personnel on any changes to entry and exit routes.

Employees will be transported to the Dixie Medical Center in St. George, Utah, or other facility if they are injured, become ill, or develop signs or symptoms due to possible overexposure involving hazardous substances or health hazards.

All accidents and injuries that occur at the site will be reported to the Site Safety Officer prior to the end of the workday. All injuries will be reported regardless of the apparent severity. Likewise, all possible overexposures will be reported even though adverse health effects or symptoms may not be initially apparent. An injury report form (Supplement B3) will be completed for all accidents and injuries.

B.3.7.3 Incident Investigation

The Site Safety Officer will investigate all incidents to determine cause and necessary corrective action to be taken to prevent like accidents from occurring. These written reports will be maintained in a project file and made available only to authorized personnel.

B.3.7.4 First Aid

The Site Safety Officer will be required to have current CPR and first aid training. First aid kits will be required at each active work area.

B.3.7.5 Communications

Telephones are located in the OMG Americas Apex Plant office. Cell phone coverage is available.

B.3.8 Training

B.3.8.1 Required Courses and Meetings

Employees engaged in field activities must have successfully completed Occupational Safety and Health Administration (OSHA) worker training in compliance with 29 CFR 1910.120. For employees who have completed OSHA training, an 8-hour refresher course shall be completed annually. Site managers and supervisors shall successfully complete an 8-hour supervisor's course in addition to other training received. Attendance at the initial Site Safety Meeting and other as-needed Site Safety Meetings shall also be required of all personnel working on site.

B.3.8.2 Worker Right to Know

As part of the training required under 29 CFR 1910.120 and 1910.1200, workers shall be familiarized with material safety data sheets (MSDSs) and instructed on the terms and concepts that relate to MSDSs (if applicable). Contractors and subcontractors will provide the Site Safety Officer with a written HAZCOM plan together with all the MSDSs for potential hazardous products they are using (if applicable). As part of the Site Safety Meetings, the Site Safety

Officer shall review hazardous materials that will be used and the precautions that will be taken when working with these materials. MSDSs shall be kept in a binder at the site for reference by workers.

B.3.8.3 Emergency Recognition

During the initial Site Safety Meeting, all employees will be trained to recognize and respond to on-site emergencies, and to anticipate and avoid hazards discussed in this HASP.

B.3.8.4 Physical Hazards

Possible physical hazards and high interest areas will be identified and discussed at the initial Site Safety Meeting by the Site Safety Officer or authorized subcontractor representative. These hazards may include, but are not limited to:

- Drill rig operation
- Overhead hazards
- The use of power tools
- Electrical hazards
- Underground utilities or buried materials
- Overhead power lines
- Dust and noise generated by activities on-site
- Excavating for soil sample collection
- Steep slopes and tripping hazards
- Plants and particulate matter creating eye injury hazards
- Insect and snake bites.

B.3.9 Records

The Site Safety Officer shall be responsible for maintaining records relevant to the HASP. The records will be available at all times. A log book of the following information shall be kept:

- Daily work activities
- Make and model of equipment used
- Dates, time, and a list of attendees at safety meetings
- All incidents and accidents.

Verification of compliance with applicable training programs will be maintained by the responsible contractor.

B.3.10 Addenda

Addenda to the HASP may be implemented based on newly acquired information or unforeseen situations which may arise. The addenda will state any changes, deletions, or additions to the HASP. Addenda shall be approved and signed by the Site Safety Officer before taking effect.

B.4 SPECIFIC HEALTH AND SAFETY REQUIREMENTS

B.4.1 Work Activities

The work that will be conducted at Pond 2 consists of implementation of tasks required by the Work Plans and may include but is not limited to the following activities:

- Collecting surface water samples
- Excavating backhoe trenches
- Completing soil borings
- Collecting soil samples.

Activities will consist of augering and sampling tasks that use heavy equipment and hand equipment. Material that will be excavated or moved may have elevated concentrations of metals. Work may also be conducted in areas where metal-contaminated water is flowing or ponded.

B.4.2 Chemical Hazards

Soil and water constituents detected in EPA or Hecla samples collected at Pond 2 include arsenic, barium, cadmium, chromium, cobalt, copper, lead, nickel, selenium, silver, tungsten, and ammonia (EPA, 1999). High exposure to these constituents can potentially cause detrimental effects on human health. Paths of exposure to humans include inhalation or ingestion of airborne dust and dermal exposure. Exposure to these constituents will be minimized by proper use of personal protective equipment (PPE) (see Section B.4.5), engineering controls, and dust suppression (see Section B.4.4).

Acids used to preserve water samples can present a hazard to the skin and eyes through direct contact, and lungs if it is inhaled or ingested. Acute symptoms may include skin burns, eye and sinus irritation and nausea. If acute symptoms are detected, work is to stop and workers are to withdraw and rinse their eyes and skin.

Measurement probes will be utilized to evaluate water pH levels whenever the potential exists for contacting acidic water. Latex gloves will be used when handling wet items and acidic preservatives. Safety goggles or face shields will be used if the potential for splashing exists.

B.4.3 Noise Monitoring Requirements

During drilling or heavy equipment operation, noise levels may excessive. Hearing protection will be required when within 25 feet of an operating drill rig or heavy equipment. Contractors and subcontractors will be responsible for providing hearing protection equipment to their employees.

B.4.4 Engineering Controls

Dust suppression techniques, primarily watering, shall be used to the maximum extent practicable. Motorized equipment will have mufflers and noise suppression devices as required.

B.4.5 Personal Protective Equipment

All work will be conducted in PPE Level D protection as follows:

- Hard hat
- Safety glasses
- Steel-toed safety boots
- Ear plugs (as needed)
- Sunscreen (as needed)
- Cotton overalls (as needed)
- Latex gloves (during short term contact with water and soil).

B.5 REFERENCES

U.S. Environmental Protection Agency (EPA), 1999. Order Requiring Monitoring, Testing, Analysis and Reporting. United States Environmental Protection Agency, Region VIII. RCRA Docket. Proceeding Under Section 3013 of the Resource Conservation and Recovery Act, 42 U.S.C. § 6934. Docket No.: RCRA-8-99-06. September.

National Institute for Occupational Safety and Health (NIOSH), 1985. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities Prepared by: National Institute for Occupational Safety and Health (NIOSH), Occupational Safety and Health Administration (OSHA), U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (EPA). October.

SUPPLEMENT B1

SAFETY COMPLIANCE FORM

Hecla Mining Company

EMPLOYEE SAFETY COMPLIANCE AGREEMENT

I,____________________________(print name) have received a copy of the Health and Safety Plan for the Hecla Mining Company Apex site. I have read the plan, understand it, and agree to comply with all of the health and safety requirements. I understand that I may be prohibited from working on the project for violating any of the requirements.

Signature____ Date____________________

SUPPLEMENT B3

ACCIDENT REPORT FORM

ACCIDENT REPORT

Site description		Project description
Report date	Accident date	Preparer's name
Name and affiliation of injured person		Social security number
		Age
		Years of service/experience
		Time present on site
		Title/classification

Severity of injury

9 no medical attention 9 medical attention 9 non-disabling 9 disabling 9 fatality

Classification of injury

9 fractures	9 bites	9 toxic respiratory exposure	9 faint/dizziness
9 dislocations	9 heat burns	9 toxic ingestion	9 dermal allergy
9 sprains	9 chemical burns	9 cold exposure	
9 abrasions	9 concussion	9 frostbite	
9 lacerations	9 bruises	9 heat stroke	
9 punctures	9 blisters	9 heat exhaustion	

Part of body affected	Degree if disability
Date medical care was received	Place where medical care was received

Location of accident

Causative agent most directly related to accident (e.g., object, substance, material, machinery, equipment conditions)

Was weather a factor?

9 YES
9 NO

Unsafe mechanical/physical/environmental conditions at the time of the accident

ACCIDENT REPORT (continued)	
Unsafe act by injured and/or others contributing to the accident	
Personal factors (e.g., improper attitude, lack of knowledge or skill, slow reaction, fatigue)	
Level of personal protective equipment required in the site-specific health and safety plan for this activity	
What can be done to prevent the reoccurrence of this type of injury?	
Witnesses to accident	Preparer's signature
	Health and Safety Officer's signature
DETAILED NARRATIVE DESCRIPTION OF ACCIDENT (How and why did the accident happen? What tools, circumstances or assigned duties contributed to the accident? Be specific. Use additional sheets if necessary).	

SUPPLEMENT B2

EMERGENCY RESPONSE INFORMATION

Emergency Response Contacts

Personnel/Agency	Telephone Number
Primary Contact: Hecla Mining Company	208-769-4100
Ambulance (Dixie Medical Center)	911
Fire (St. George Fire Department)	435-634-5888
Local Law Enforcement (Washington County Sheriff)	911
Hospital (Dixie Medical Center)	435-634-4200

ATTACHMENT C

STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE NO. 1

SURFACE WATER SAMPLE COLLECTION

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

STANDARD OPERATING PROCEDURE NO. 1
SURFACE WATER SAMPLE COLLECTION
Version 0.0

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LIST OF FIGURES

1.0 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for the collection of surface water samples at and in the vicinity of the Hecla Apex Site (Site). This document gives descriptions of the equipment, field procedures, and quality assurance/quality control (QA/QC) procedures necessary for collecting surface water samples from streams, ponds and seeps.

2.0 RELATED STANDARD OPERATING PROCEDURES

This procedure is intended to be used with the following SOPs:

- SOP No. 2 Surface Water Flow Measurement
- SOP No. 4 Decontamination
- SOP No. 5 Sample Handling, Documentation, and Analysis
- SOP No. 6 Data Validation.

3.0 EQUIPMENT REQUIRED FOR SURFACE WATER SAMPLING

3.1 General Equipment Requirements

The following general equipment may be required to collect surface water samples:

- Watch
- Backpack
- Field logbook
- Surface water data sheets (see Figure 1)
- Mobile telephone or radio
- Appropriate health and safety equipment

- Camera
- Plastic flagging.

The following equipment may be required for field parameter measurements:

- pH meter (with automatic temperature compensation)
- Electrical conductivity meter (with automatic temperature compensation)
- Plastic squeeze bottle filled with deionized or distilled water
- Polyethylene or glass containers (for field parameter measurements)
- Beakers
- Kimwipes® or equivalent
- Calculator
- Field logbook
- Appropriate health and safety equipment.

The following equipment for sampling of surface water may be needed:

- Clean sample bottles obtained from the laboratory
- Beakers of assorted sizes
- Peristaltic pump and battery
- Tygon® or silicone tubing
- Disposable latex gloves.

Use the following equipment for sample labeling, packing, documentation, and performing chain-of-custody procedures:

- Sample labels
- Appropriate preservatives
- Field logbook and surface water data sheets

- Chain-of-custody forms
- Disposable latex gloves
- Permanent markers and waterproof pens
- Clear plastic tape
- Fiber tape
- Custody seals
- Plastic trash bags
- Cooler
- Ziploc®-type freezer bags
- Ice
- Shipping documentation.

4.0 SURFACE WATER SAMPLING PROCEDURES

This section gives the step-by-step procedures for collecting surface water samples in the field. Observations made during sample collection shall be recorded in the field logbook and on the surface water data sheets (Figure 1).

4.1 Decontamination

Before beginning a sampling event and between collecting individual samples, decontaminate sample collection equipment as specified in SOP No. 4.

4.2 Obtaining Water Samples

Collect surface water samples as follows:

- Assemble all necessary sample collection equipment.
- Decontaminate non-disposable sampling equipment as specified in SOP No. 4.
- Obtain sample bottles for filling. Pre-acidize or acidize in the field for sample preservation as indicated by the laboratory.

- Wear clean, disposable latex gloves at all times when collecting samples.
- Ensure that no activities are occurring or have recently occurred immediately upstream of the sampling location that would affect the integrity of the sample. Avoid disturbing stream sediments or otherwise contaminating samples. Collect sample in a decontaminated transfer beaker or other container; fill sample bottles. When collecting samples at successive locations, always proceed from downstream to upstream locations.
- Fill transfer container/beaker/bottle. If the transfer container cannot be filled due to low water depth, use a peristaltic pump and tubing to pump sample water directly into sample bottles, being careful to minimize sediment uptake.
- Measure field parameters (e.g., pH, electrical conductivity, visually estimate turbidity) directly at the sampling location or from a separate aliquot of the unfiltered sample. Record field parameters in the field logbook or on field data sheets. Record the time of sampling in the field logbook or on the field data sheets.
- Complete bottle labels indicating location, date, time, preservation, filtered or unfiltered sample and other lab-required sample data. Place completed labels on the sample bottles and secure the labels with clear plastic tape.
- Place the bottled, labeled samples in plastic/Ziploc® freezer bags.
- Place the plastic/Ziploc® freezer bags containing samples on ice in a cooler.
- Complete the field documentation and chain-of-custody form(s).

If no surface water flow is observed, seepage may be collected by digging a hole and allowing time for liquid to accumulate in the hole and solids to settle out.

If surface water flow will subsequently be measured (see SOP No. 2), collect samples near the cross-section of the stream that will be used to measure discharge. Always collect the samples for chemical analysis before measuring discharge or upstream of the measurement point to avoid sediment disturbance.

4.3 Quality Assurance/Quality Control (QA/QC) Procedures and Samples

Field QA/QC samples shall be collected in accordance with the QAPP of the work plan and shall include field rinsate samples, field duplicate samples, and field blank samples.

4.3.1 Rinsate Samples

To evaluate the effectiveness of water sampling decontamination procedures, equipment rinsate samples of decontaminated sampling equipment shall be collected. The rinsate sample shall be collected by rinsing de-ionized or distilled water over the decontaminated sampling equipment and transferring the water to the sample bottles. Assign the rinsate sample an appropriate identification number and follow SOP No. 5 for documentation preservation, handling, packaging, and chain-of-custody procedures.

4.3.2 Duplicate Samples

To check for the natural sample variance and the consistency of field techniques and laboratory analysis, duplicate water samples shall be collected side-by-side with primary samples. After filling the primary sample bottles, immediately fill the duplicate sample bottles until all necessary sample bottles for both the primary and duplicate samples have been filled. Handle the duplicate surface water sample in the same manner as the primary sample. Assign the duplicate samples an appropriate identification number and follow SOP No. 5 for documentation, preservation, handling, packaging, and chain-of-custody procedures.

4.3.3 Blank Samples

Collect field blanks by filling sample containers in the field with deionized water. Assign the blank samples an appropriate identification number and follow SOP No. 5 for documentation, preservation, handling, packaging, and chain-of-custody procedures.

4.3.4 Field Calibration Checks

In order to determine if the pH meter, temperature, and conductivity meter measurements are accurate, the pH meter and conductivity meter calibrations shall be checked daily against a known standard. The check standard should be approximately the same pH range or conductivity range as that expected for the water samples being collected. If the conductivity meter reading differs by more than 10 percent from the check standard, the conductivity meter shall be recalibrated. If the pH reading differs by more than 0.1 pH units from the check standard, the pH meter shall be recalibrated. All check standard readings and recalibrations shall be recorded in the field logbook.

4.4 Sample Handling

Sample containers, parameter holding times, and preservatives are specified in SOP No. 5. Samples shall be labeled and handled as described in SOP NO. 5. The parameters for analysis are specified in the work plan.

5.0 FIELD METER CALIBRATION AND MEASUREMENT

5.1 pH Meter

The pH meter shall be calibrated each day before taking any readings of samples. Calibration and operation of the pH meter shall be performed according to the manufacturer's specifications and instructions. In general, calibration is done by adjusting the meter with standard buffers that bracket the expected pH of the field water. The procedures described in this section are generalized from calibration procedures written for Hach Company EC10 and EC20 pH meters.

5.1.1 Required pH Measurement Equipment

Use the following apparatus and supplies for measuring pH in the field:

- Portable pH meter
- Spare pH probe or electrolyte cartridge, as applicable
- pH electrode storage solution
- Extra batteries
- Beakers
- Buffer solutions of pH 4, 7, and 10
- Wash bottle of de-ionized or distilled water
- Kimwipes® or equivalent.

Measure the pH from a water sample as soon as possible after collecting it. Determine the pH by the electrometric method using standard buffer solutions. The electrometric method is the preferred method because of its greater accuracy and ease of measurement. Either a glass electrode and a reference electrode, or a combination electrode, which combines the glass membrane electrode and the reference electrode, shall be used.

The pH meter shall automatically compensate for temperature and be capable of calibration with a two-point (using two buffers) slope adjustment method. The pH meter shall have a precision of at least 0.05 pH units.

5.1.2 pH Meter Calibration Procedures

Before collecting samples, calibrate the pH meter in accordance with the manufacturer's instructions using calibration (buffer) solutions. Record all pH measurement data, including calibration dates and times, readings, the meter number, and sample temperatures on a surface water data sheet or in a field logbook.

Calibrate the pH meter at least once per day, at the start of each sampling day, and as needed during the day, especially when measuring waters with substantially different pH values. Check the pH calibration against a known standard daily, and recalibrate as necessary (see Section 4.3.4). Thoroughly document all calibrations; record the buffer readings and temperatures, in the field logbook or data sheets. Field sampling personnel shall do the following when calibrating the meter according to the manufacturer's procedures:

- Condition pH electrodes by soaking them for at least one hour in pH electrode storage solution. pH electrodes that have been properly stored in pH electrode storage solution do not need to be conditioned.
- One of the buffer solutions used for the slope adjustment should approximate the anticipated pH of the sample, and the other buffer should have a pH of 7. Ensure that the buffer solutions are the same temperature and are as close as practical to the temperature of the water to be measured. Use aliquots of the buffer solutions once and then discard the aliquots.

- Before immersing the probe(s) into the buffer or sample, rinse the probe with de-ionized or distilled water and blot it dry with clean Kimwipes® or equivalent. Protect the glass tip of the probe from abrasion and scratching.

- Calibrate the meter with the two buffer solutions (two-point slope adjustment) at least once daily (or more often if conditions warrant or if specified by the manufacturer).

- If the calibrated slope of the pH meter deviates significantly from its theoretical value, test for a potentially defective electrode or contaminated buffer solution.

- Always use the same electrode for measurements that was used for calibration.

- Recalibrate the meter if the electrode is replaced.

5.1.3 pH Measurement

The sampler shall measure pH as follows:

- If the pH is measured in a container, rinse the sample container with deionized water and then rinse with the sample water prior to measurement. Rinse the pH probe with deionized water and blot the probe dry with clean Kimwipes® or equivalent. Protect the fragile glass bulb at the end of the probe from damage.

- Immerse the electrode in the water, allow the pH reading to stabilize, and monitor the drift of the instrument. Do not immerse the electrode above the top of the pH probe. When the pH reading stabilizes (i.e., the meter beeps), record the temperature to the nearest 0.1 °C and the pH reading to the nearest 0.01 unit.

- Between measurements, store the electrode in Hach pH electrode storage solution or equivalent solution, if possible. Alternatively, place a cotton swab soaked in electrode solution in the protective cap of the electrode.

- Measure the pH of samples within 15 minutes after sampling and on a separate aliquot of the sample.

- If using a Hach One pH meter, dispense electrolyte if the reading becomes unstable or erratic or if stabilization takes too long. An unstable reading may also indicate an air bubble in the reference line. Depress the dispenser button repeatedly until the bubble is expelled (5 to 10 clicks should be sufficient). Note that it is not necessary to refresh the electrolyte gel at the reference outlet between readings unless the reading does not stabilize within a reasonable period of time.

- Store the electrode on a short-term basis (between measurements/up to one week) in the Hach pH electrode storage solution or place a cotton swab that has been soaked in pH electrode storage solution in the pH probe protective cap. Do not store the electrode in deionized water, as this will shorten the electrode life.

- Avoid prolonged exposure of the pH meter and probe to sunlight. Avoid abruptly moving the meter between radical temperature variations.

5.2 Conductivity Meter

Electrical conductivity, or specific conductance, is the ability of water to conduct an electric current and depends on the concentration of ions in solution. For measuring conductivity in the field, the meter shall have an automatic temperature compensator. Electrical conductivity shall not be measured on a sample that was first used to measure pH. Potassium chloride that diffuses from the pH probe can alter the conductivity of the sample.

5.2.1 Required Conductivity Measurement Equipment

Use the following apparatus and supplies for measuring conductivity in the field:

- Conductivity meter
- Extra batteries
- Calibration solutions that bracket the expected range of measurements
- Wash bottle of de-ionized or distilled water
- Kimwipes® or equivalent
- Beakers.

5.2.2 Conductivity Meter Calibration

Before collecting samples, calibrate the conductivity meter using calibration solutions in accordance with the manufacturer's instructions. The sampler shall record all conductivity measurement data, including calibration dates, readings, the meter number, and sample temperatures on a surface water data sheet or in a field logbook.

Reagent-grade potassium chloride (KCl) or other equivalent solutions are used as reference solutions to calibrate conductivity equipment. The reference solutions are also used to check the accuracy of the meter. The conductivity of the reference solutions that are used to calibrate the meter should bracket the expected range of the conductivity of the water samples. Commercially prepared calibration standards are available from laboratory suppliers at many standard concentrations.

The sampler shall calibrate the meter as follows:

- Calibrate the meter according to the manufacturer's instructions.
- Prepare or obtain standard reference solutions of a known value at a known temperature. Adjust the meter or the calibration solution to the correct temperature.
- Adjust the meter to read the reference conductivity. Rinse the probe with deionized water and blot the probe dry. Re-immerse the probe in the reference solution and read the measured value to validate the corrected conductivity.

Check the calibration of the conductivity meter daily, and recalibrate as necessary (see Section 4.3.4).

5.2.3 Conductivity Measurement

Measure conductivity immediately after a sample is collected. Record conductivity readings to the nearest 1 μS/cm (for samples with conductivities less than 2,000 μS/cm) or 0.01 mS/cm (for samples with conductivities greater than 2.00 mS/cm), corrected to 25°C.

The sampler shall measure conductivity as follows:

- Rinse the probe with deionized water and blot the probe dry with clean Kimwipes® or equivalent, without wiping the plating on the cell.
- Insert the probe into the sample solution. Immerse the tip to or beyond the vent holes and agitate the probe vertically. Make sure that air bubbles are not trapped near the temperature sensor. Allow the reading to stabilize before recording measurements. Record the conductivity and temperature of the sample.

- During normal use, rinse the probe thoroughly with deionized water between measurements to minimize the buildup of interfering substances on the probe element.
- Avoid prolonged exposure of the probe to sunlight.

6.0 DOCUMENTATION

6.1 Surface Water Data Sheet

Complete a surface water data sheet (Figure 1) for surface water samples at each sampling location. Be sure to completely fill in the data sheet. If items on the sheet do not apply to a specific location, label the item as not applicable (NA). The information on the data sheet includes the following:

- Sampling location
- Date and time of sampling
- Weather conditions
- Person(s) performing sampling
- Field parameters including conductivity, temperature, pH,
- Field meters used and calibration information
- Sample identification number(s)
- QA/QC samples taken at the location
- Method of sample collection (e.g., beaker, pump, poly dipper).

FIGURE 1 SURFACE WATER SAMPLING DATA SHEET

IDENTIFICATION

Sample Location ____________ Date ________ Start Time ________ Stop Time ________ Page _____ of ______

Sample Control Number ______________________ Samplers ______________________

WEATHER CONDITIONS

Ambient Air Temperature: ________ °C °F Measured ? Estimated ?

Weather: Sunny Partly Cloudy Cloudy Rain Snow Heavy Moderate Light

INSTRUMENT CALIBRATION

pH Meter: Meter Make/Model Number ______________________

Buffer ____________ Measured Value ____________ Temp. ____________ °C °F

Buffer ____________ Measured Value ____________ Temp. ____________ °C °F

Conductivity Meter: Meter Make/Model Number ______________________

Standard Value ____________ µS/cm Measured Value ____________ Temp. ________ °C °F

Standard Value ____________ µS/cm Measured Value ____________ Temp. ________ °C °F

SAMPLE LOCATION DESCRIPTION

____

____

____

SAMPLE COLLECTION PROCEDURE

____

____

____

DISCHARGE MEASUREMENT

Method: ____

Comments/Observations: ____

____

Discharge: ______________________ Staff gauge: ______________________

FINAL SAMPLE PARAMETERS

Sample Date	Sample Time	Discharge (gpm)	pH	Cond. (mS/cm)	Temp (°C)	Total Iron (mg/L)	Ferrous Iron (Fe^{2+}) (mg/L)	Dissolved Oxygen (mg/L)

Was a duplicate sample collected (02) Yes No (Sample control number ____________________)
Was a field blank sample collected (03) Yes No (Sample control number ____________________)
Was a rinsate sample collected (04) Yes No (Sample control number ____________________)

Notes: ____

____

Sampler's Signature: ______________________________

STANDARD OPERATING PROCEDURE NO. 2

SURFACE WATER FLOW MEASUREMENT

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

STANDARD OPERATING PROCEDURE NO. 2
SURFACE WATER FLOW MEASUREMENT
Version 0.0

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1.0 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedures (SOP) for measuring surface water discharge in ditches and seeps at the Hecla Apex Site (site). Discharge shall be expressed in units of cubic feet per second (cfs) or gallons per minute (gpm). This SOP outlines the following methods that may be used for measuring flow: (1) the portable cutthroat flume method or (2) the volumetric method (time and volume).

2.0 RELATED STANDARD OPERATING PROCEDURES

This procedure is intended to be used with SOP No. 1, Surface Water Sample Collection.

3.0 NECESSARY EQUIPMENT

The following general equipment may be utilized to measure surface water flow:

- Watch
- Field logbook
- Permanent pens
- Surface water sampling data sheets
- Portable cutthroat flume with assorted throat sizes
- Small level
- Shovel
- 25 or 50 foot fiberglass tape
- Calibrated containers to measure flow
- 2-inch polyvinyl chloride (PVC) pipe.

4.0 DISCHARGE MEASUREMENT PROCEDURES

Depending on the magnitude of the discharge and the physical conditions at the measurement site, discharge shall be measured with a portable cutthroat flume or using the volumetric method.

If either of these methods cannot be used to measure discharge at a particular sample location, then: (1) other methods may be selected and added as addenda to this SOP, (2) the measurement point may be relocated so that discharge can be measured, or (3) the flow rate may be visually estimated. Whether or not a measurement is made, the sampling technician shall note the conditions that affected flow measurement.

4.1 Location of Stream Measurement Points

The selection of the point at which to measure stream discharge depends on a number of factors, including data acquisition requirements, accessibility, and stream flow characteristics. When flow is measured in conjunction with water-quality sampling, take flow measurements as close as possible to the sample collection point. To avoid disturbing the sediments or otherwise contaminating samples, measure flow after collecting water-quality samples and immediately downstream of the sample collection point. Stream flow characteristics shall be used to determine the exact point where the discharge measurements will be made and the method used for measuring discharge; these characteristics may include ease of measurement, channel alignment, flow regime, flow depth, and velocity. Consider the following factors when selecting a measurement point:

- Ease of measurement. The point should be accessible and flow should be confined to a definable channel.
- Flow regime. Stream flow should be steady and uniform, the stream-bed gradient in the vicinity should be relatively constant, and flow-lines should be as close to parallel as possible.
- Backwater effects. The measurement site should be free from backwater caused by downstream obstructions or by the confluence of the stream with a major tributary or other body of water.
- Depth and velocity limitations. Flumes must have a sufficient depth to function properly. Equipment instructions should be checked to ensure proper performance at the selected point.

4.2 Flumes

Flumes are specially shaped open-channel flow devices that constrict channel area and change the slope to force the flow through critical depth. Typical flumes consist of three sections:

- A converging section to accelerate the approaching flow
- A throat section, whose width is used to designate flume size
- A diverging section, designed to ensure that the level downstream is lower than the level in the converging section.

Additional information concerning the use of flumes under all flow conditions, including submergence, is located in USGS Water-Supply Paper 2175, Volume 2, Chapter 10.

4.2.1 Portable Cutthroat Flumes

A portable cutthroat flume with interchangeable throat widths, typically ranging from 1 to 8 inches, can be used to measure discharges. Place a portable cutthroat flume in a stream channel section with a bed slope of less than approximately 1 percent for a distance of 4 to 6 feet upstream of the flume. When the proper throat width is used, a pool of water with a width at least twice the front width of the flume should form upstream of the flume.

The following steps shall be performed when installing and measuring discharge from a portable cutthroat flume:

- Assemble, install, level, plumb, and square the flume
- Install the flume so that free-flow discharge occurs (flow through the flume discharges freely)
- Divert all stream flow through the flume inlet, being careful to seal the sides and bottom of the flume so that flow does not pass around or underneath the flume
- Remove any material that may have accumulated in the flume
- Record the time and date of flow measurement
- After the flow has equilibrated, use the staff gage to measure and record the gage height to the nearest 0.01 of a foot
- Take and record two identical staff gage measurements 2 minutes apart to verify that flow has equilibrated
- Record the amount of leakage as an estimated percentage of the total measured flow.

4.3 Volumetric Flow Measurement

The volumetric method consists of capturing flow in a container and measuring the time required to fill the container. When using this method, divert the flow through a culvert or pipe and measure the discharge at the point of outflow. Alternatively, a small earthen dike can be built to divert seepage flow through a pipe into a container with a known volume. Use a stopwatch and record the time required to fill the container.

If practical, repeat the measurement at least three times and average the resulting values. If the variance between the time measurements exceeds 10 percent, repeat the measurement procedure. If any leakage occurs through or around the dike, estimate the amount of leakage as a percentage of the total measured flow and add the estimated leakage to the measured flow in order to calculate the total flow.

5.0 DOCUMENTATION

All information pertaining to stream flow measurements shall be recorded in a bound field logbook. If surface water samples are to be collected at the time of flow measurement, the information can be recorded on a surface water sampling data sheet (SOP No. 1). The information recorded shall include the following, as appropriate:

- Location
- Date and time
- Method of flow measurement (flume, volumetric method)
- Flow measurement (or data, such as gauge measurement, flume throat width, such that flow can be calculated)
- Unusual conditions at measurement location or conditions that prevented measurement
- Name of person(s) performing observations
- Photographs taken.

STANDARD OPERATING PROCEDURE NO. 3

SOIL SAMPLING

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

STANDARD OPERATING PROCEDURE NO. 3
SOIL SAMPLING
Version 0.0

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1.0 PURPOSE AND SCOPE

This document outlines the Standard Operating Procedure (SOP) for collecting soil and other solid samples at and in the vicinity of the Hecla Apex site (site). This SOP serves as a supplement to the Quality Assurance Project Plan (QAPP) included as Attachment A of the work plan.

2.0 RELATED STANDARD OPERATING PROCEDURES

This procedure is intended to be used with the following SOPs:

- SOP No. 4 Decontamination
- SOP No. 5 Sample Handling, Documentation, and Analysis
- SOP No. 6 Data Validation.

3.0 EQUIPMENT NECESSARY FOR SOIL SAMPLING

3.1 General Equipment Requirements

Equipment that may be used for soil sampling includes:

- Field book, sampling data sheets, and permanent pens
- Engineers measuring tape
- Shovel
- Stainless steel mixing bowl and sampling spoon
- Plastic Ziploc®-type freezer bags
- Auger drill rig with split-spoon or dry-core sampling capabilities
- Backhoe or hydraulic excavator.

4.0 SOIL SAMPLING PROCEDURES

4.1 Hand Auger Sampling Procedures

- All sampling equipment shall be decontaminated as directed in SOP No. 4 prior to sample collection and between samples.
- Samples shall be collected from the auger flights using a decontaminated shovel, stainless steel spoon, or similar tool.
- At each proposed soil sampling location, each soil sample shall be collected from depth intervals specified in the work plan or as modified based on field observations. Samples shall be collected above and below any identifiable interfaces (staining horizon, lithologic changes, or other material characteristic changes) within the profile.
- Samples shall be collected using containers and preservation methods listed in Table 1 of SOP No. 5. Each soil sample shall be collected by scraping, spooning, or shoveling soil directly into the specified container.
- Following collection, soil samples shall be handled in accordance with SOP No. 5 (Sample Handling, Documentation, and Analysis). The sample designation, depth, location, date, time, and sampling team members shall be recorded on a sample data sheet and/or in the logbook.

4.2 Drill Sampling Procedures

- All sampling equipment shall be decontaminated as directed in SOP No. 4 prior to sample collection and between samples.
- Soil samples shall be collected from the split barrel sampler within hollow stem augers using a decontaminated stainless steel spoon, spatula, or similar tool.
- Samples shall be collected from depth intervals specified in the work plan or as modified based on field observations. Samples shall be collected above and below any identifiable interfaces (staining horizon, lithologic changes, or other material characteristic changes) within the profile.
- Samples shall be collected using containers and preservation methods listed in Table 1 of SOP No. 5. Each soil sample shall be collected by scraping or spooning soil directly from the core into the specified container.
- Following collection, soil samples shall be handled in accordance with SOP No. 5 (Sample Handling, Documentation, and Analysis). The sample designation, depth, location, date, time, and sampling team members shall be recorded on a sample data sheet and/or in the log book.

5.0 DOCUMENTATION

Field activities shall be properly documented to facilitate timely and accurate reconstruction of events in the field. All information pertinent to soil sampling shall be recorded in a bound field logbook or on sample data sheets. Entries in the logbook shall include the following, as applicable:

- Name and title of author, date and time of entry, and physical/environmental conditions during field activity
- Names of personnel and any visitors
- Location, description, and log of photographs
- Sampling equipment and method
- Information concerning sampling decisions
- Samples collected, intervals, types, and identification number
- Field observations
- Summary of daily tasks and information concerning sampling method changes and scheduling modifications
- Sample preparation procedure
- Signature and date by personnel responsible for observations.

The logbook shall contain sufficient information so that the sampling activity can be reconstructed without relying on the memory of field personnel. The logbooks shall be kept in the field technician's possession or in a secure place during the investigation. Following the investigation, the logbooks shall constitute a portion of the permanent project record.

STANDARD OPERATING PROCEDURE NO. 4

DECONTAMINATION

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

STANDARD OPERATING PROCEDURE NO. 4
DECONTAMINATION
Version 0.0

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1.0 PURPOSE AND SCOPE

The purpose of this document is to define the Standard Operating Procedure (SOP) for decontamination of personnel and equipment during investigations at and in the vicinity of the Hecla Apex Site (Site).

The overall objective of multimedia sampling programs is to obtain samples that accurately depict the chemical, physical, and/or biological conditions at the sampling site. Extraneous contaminant materials can be introduced into the medium of interest during the sampling program (e.g., by contacting water with equipment previously contaminated at another sampling site). Trace quantities of these contaminant materials can thus be captured in a sample and lead to false positive analytical results and, ultimately, to an incorrect assessment of the contaminant conditions. Decontamination of personnel, sampling equipment (e.g., bailers, pumps, tubing, and soil and sediment sampling equipment), and field support equipment (e.g., drill rigs and vehicles) is therefore required to minimize the possibility of sampling cross-contamination.

2.0 RELATED STANDARD OPERATING PROCEDURES

The procedures for decontamination set forth in this SOP are intended to be used in conjunction with the following SOPs:

- SOP No. 1 Surface Water Sample Collection
- SOP No. 3 Soil Sampling
- SOP No. 5 Sample Handling, Documentation, and Analysis
- SOP No. 6 Data Validation.

3.0 EQUIPMENT NECESSARY FOR DECONTAMINATION

The following is a list of equipment that may be necessary to perform decontamination activities:

- Laboratory wash bottles
- Brushes

- Wash tubs (plastic)
- Buckets (plastic)
- Scrapers
- High-pressure washer (for heavy equipment)
- Paper towels
- Liquinox™ detergent (or equivalent)
- Approved decontamination water
- Deionized or distilled water
- Garden type water sprayers
- Wash bottles
- Disposable latex gloves
- Clean plastic sheeting and/or trash bags.

4.0 DECONTAMINATION PROCEDURES

4.1 Decontamination Area

Decontamination of heavy equipment, such as drilling equipment and backhoes, shall take place at a designated decontamination area. Decontamination shall take place such that all wash and rinse water will drain by gravity into the evaporation ponds.

4.2 Personnel Decontamination

Decontamination procedures for field personnel shall take place on an as-needed basis and may include:

- Washing boots with detergent solution and rinsing
- Removing coveralls (if used) and washing with detergent
- Removing hard hat and other safety equipment and washing with detergent solution and rinsing

- Removing gloves (if used)
- Washing hands, face, and forearms before eating/drinking.

4.3 General Decontamination Procedures for All Equipment

All equipment that will contact a sampled medium shall be decontaminated prior to use. An exception is for new supplies, such as disposable filters and tubing that are certified clean by the manufacturer. General decontamination procedures are listed below.

- Put on new latex gloves.
- Decontaminate all wash/rinse tubs before initial use and between sampling sites, as specified in Section 4.4 below.
- Following decontamination, place equipment in a clean area or on clean plastic sheeting to prevent contact with soil.

4.4 Decontamination of Sampling Equipment

Procedures for decontaminating sampling equipment are listed below.

- Scrape off gross contamination from equipment at the sampling site.
- Spray the equipment with a detergent solution contained within a garden-type sprayer, or place the equipment in a wash tub containing detergent solution, and scrub the equipment with a bristle brush or similar utensil.
- Using a second garden sprayer, or in a second wash tub, rinse equipment with approved water to remove the detergent solution.
- Rinse the equipment with deionized or distilled water from a garden sprayer or wash bottles.

4.5 Decontamination of Delicate Equipment

Equipment susceptible to water damage shall be carefully cleaned by wiping with paper towels wetted with detergent solution and deionized or distilled water.

4.6 Drilling and Heavy Equipment

Drilling and heavy equipment shall be decontaminated at the designated decontamination area for large equipment. The following steps shall be used to decontaminate drilling and heavy equipment.

- Personnel shall dress in suitable safety equipment (e.g., gloves and safety glasses or splash shields).
- Gross contamination or drill cuttings that are caked on shall be scraped off equipment with a flat-bladed scraper or shovel at the sampling or borehole location.
- Equipment such as drill rigs, augers, core barrels, drill bits, and shovels shall be sprayed with approved water. Care shall be taken to adequately clean the insides of hollow-stem augers and backhoe buckets. A high-pressure washer may be used.
- Following decontamination, drilling equipment shall be placed on the clean drill rig and moved to the next borehole location. If the equipment is not used immediately, it shall be stored in an area where it will remain clean.

4.7 Equipment Leaving the Site

Vehicles used for non-intrusive activities shall be cleaned on an as-needed basis. Cleaning shall be required for very dirty vehicles prior to leaving the site.

4.8 Waste Water

Used wash and rinse solutions from all decontamination activities shall be collected and/or directed into the primary or secondary decontamination areas.

4.9 Other Wastes

Solid wastes, such as paper towels and used filters, shall be placed in plastic bags and properly disposed.

5.0 QUALITY ASSURANCE PROCEDURES

Equipment rinsate samples shall be taken of decontaminated sampling equipment used to collect water samples to verify the effectiveness of the decontamination procedures. The rinsate procedure shall include rinsing deionized or distilled water through or over representative decontaminated sampling equipment. The rinsate water shall be collected into sample bottles, which shall be sent to the laboratory for analysis for all constituents that the primary samples are analyzed for. The rinsate collection procedure, including the sample number, shall be recorded in the field logbook.

STANDARD OPERATING PROCEDURE NO. 5

SAMPLE HANDLING, DOCUMENTATION, AND ANALYSIS

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

STANDARD OPERATING PROCEDURE NO. 5
SAMPLE HANDLING, DOCUMENTATION, AND ANALYSIS
Version 0.0

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1.0 PURPOSE AND SCOPE

This document defines the standard operating procedure (SOP) for sample documentation, handling, packaging, and chain-of-custody (COC) procedures. The American Society for Testing and Materials (ASTM) Standard Practice for Sampling Chain-of-Custody Procedures (D-4840-88) was used to prepare this SOP.

2.0 RELATED STANDARD OPERATING PROCEDURES

The procedures set forth in this SOP are intended to be used in conjunction with the following SOPs:

- SOP No. 1 Surface Water Sample Collection
- SOP No. 3 Soil Sampling.

3.0 NECESSARY EQUIPMENT

The following equipment may be used for sample labeling, packing, documentation, and COC procedures:

- Sample bottles
- Sample labels
- Field book and data forms
- COC documents
- Permanent markers, pens, and pencils
- Clear plastic tape
- Fiber tape
- Custody seals
- Large plastic trash bags
- Plastic/Ziploc®-type freezer bags

- Ice
- Sample shipment containers (coolers, buckets, boxes)
- Shipping labels.

4.0 SAMPLE HANDLING

4.1 Sample Identification

Assign unique sample identification numbers to the collected samples in order to identify the location and sample date for each sample. These numbers are required for tracking the handling, analysis, and verification or validation status of all samples collected during monitoring.

4.2 Sample Labeling

Label each sample that is collected in the field for future identification. Each label shall contain the following information, as appropriate:

- Sampler's company affiliation
- Unique sample identification number
- Sampling location
- Date and time of sample collection
- Method of preservation used (if any)
- Sample type (filtered or unfiltered)
- Sampler's initials.

After the label is completed and attached to the sample container, place clear plastic tape over the label to protect and secure the label to the container. The above information may be written directly on the bottle if labels are not available.

4.3 Sample Containers, Preservatives, and Holding Times

4.3.1 Sample Containers

Observe proper sample handling practices (Section 4.5) to minimize sample contamination and potential repeat analyses due to anomalous analytical results. Commercially cleaned sample containers from the analytical laboratory shall be used. Label the bottles as described in Section 4.2. Sample container sizes and types (e.g., plastic or glass) are presented in Table 1.

For soil samples, use only new plastic/Ziploc®-type storage bags or containers that have been adequately decontaminated according to SOP No. 4.

4.3.2 Sample Preservation

Water samples are preserved to prevent or minimize chemical changes that could occur during transit and storage. Preservation methods include refrigeration or placing samples on ice and adding certain chemicals. Preserve samples in the field to ensure that laboratory results are not compromised by improper coordination of preservation requirements and holding times. Store samples on ice in coolers before and during shipping. Specific preservation requirements for water samples are specified in Table 1.

4.3.3 Sample Holding Times and Analyses

Sample holding times are established to minimize chemical changes in a sample before analysis and/or extraction is performed. A holding time is defined as the maximum allowable time between sample collection and analysis and/or extraction, based on the nature of the analyte of interest, preservation method, and chemical stability factors. Holding times are specified in Table 1. All samples shall be shipped in time to ensure that holding times are not exceeded.

4.4 Sample Packaging and Shipping

4.4.1 Water Samples

Ship water samples in such a manner that holding times are not exceeded and required storage temperatures are maintained. The field sampling technician shall pack water samples for shipment as follows:

- Obtain an appropriately sized cooler of good quality in which to pack the samples.
- Place sample bottles in an appropriately sized plastic/Ziploc®-type bag, and place the bottles upright.
- If required, use packing material to fill voids in the cooler.
- Verify that all samples in the cooler have been documented on a COC form. Record the number of the shipping document on the COC form. Sign and date the COC form and retain a copy of it. Place the COC form in a 1-gallon Ziploc®-type plastic bag and place the COC form in the shipping cooler.
- Seal the cooler and drainhole with plastic or fiber tape and make sure the cooler has no leaks (shipping companies will not handle leaking coolers).
- Attach a signed custody seal across the cooler top.
- Attach an address label with the laboratory address and phone number and with a return address and phone number.
- Attach the shipping document and retain a copy of the shipping document with the COC form.

4.4.2 Soil Samples

For packaging and shipping of soil samples, ship the samples in a sealed container of good quality. The field sampling technician shall pack soil samples for shipment as follows:

- Obtain an appropriately sized container of good quality in which to pack the samples (a cooler, a 5-gallon bucket, or other container).
- Place bulk soil samples directly in the container. If several soil samples are to be placed in the container, the samples shall be double-bagged in appropriately sized freezer Ziploc®-type plastic bags and placed in the container.

- Verify that all samples in the container have been documented on a COC form. Record the number of the shipping document on the COC form. Sign and date the COC form and retain a copy of it. Place the COC form in a 1-gallon Ziploc®-type plastic bag and place the COC form in the shipping container.

- If ice is required to keep samples cool, use a cooler as the shipping container and double-bag ice in plastic bags. Use enough ice to keep the samples cool until they are received by the laboratory.

- Seal the container with plastic or fiber tape.

- Attach a signed custody seal across the container top.

- Attach an address label with the laboratory address and phone number and with a return address and phone number.

- Attach the shipping document and retain a copy of the shipping document with the COC form.

4.5 General Sample Handling Procedures

General sample handling procedures shall include the following:

- Always make field measurements on a separate sub-sample, not on the sample that is sent to the laboratory for analysis, and discard the sub-sample after the measurements have been made.

- Do not use containers that have been used in the laboratory to store concentrated reagents or have been previously used as sample containers. Use only new containers for samples that are certified clean by the manufacturer or laboratory.

- For water samples, do not allow the inner portion of sample containers and caps to come into contact with bare hands, gloves, or other objects.

- Keep sample containers in a clean environment away from dust, dirt, fumes, and grime.

- Field personnel shall wear disposable latex or nitrile gloves when collecting water samples.

- Do not let any samples stand in the sun. Store them in coolers with ice.

4.6 Sample Storage

Samples that are collected shall be stored temporarily in a secure location during sample preparation and prior to shipping to the laboratory.

5.0 SAMPLE DOCUMENTATION

Carefully document all field activities in a field logbook or on data sheets. Field logbooks shall be bound. Record field activities in sufficient detail so that field activities can later be reconstructed from the notes.

The following sections provide procedures and formats for documenting the field data and conditions at the time of sample collection, shipment to the laboratory, and laboratory analysis. While forms are provided in relevant SOPs to document specific tasks, the field sampling technician shall maintain a field logbook for recording all other events, conditions, and observations during sampling. Record enough information to allow the sampling event to be reconstructed from the notes alone.

Field logbook and data sheet entries shall include the following information, as appropriate. Consult relevant sampling and decontamination SOPs to supplement this list.

- Project name
- Location of sample
- Weather conditions
- Sampler's printed name and signature
- Date and time of sample collection
- Sample identification number(s)
- Description of sample (matrix sampled)
- Sample depth (if applicable)
- Number and volume of samples

- Sample methods used, or reference to the appropriate SOP
- Sample handling, as appropriate, for separate sample aliquots
- Field observations
- Results of any field measurements, such as depth to water, pH, temperature, electrical conductivity, discharge rate
- Personnel present
- Decontamination procedures.

5.1 Chain-of-Custody Procedures

The custody of all samples shall be maintained and documented on the Chain-of-Custody (COC) forms. The COC forms document possession of the sample from collection through laboratory receipt.

Follow appropriate sample custody and documentation procedures to preserve sample integrity and to ensure the validity of field and laboratory data. As a result, all sample data will be traceable from the time and location of sample collection through chemical analyses and to the time when data are used. Information on the custody, transfer, handling, and shipping of samples shall be recorded on a COC form.

The objective of the custody identification and control system for the samples is to ensure, to the extent practicable, that the following occur:

- All samples scheduled for collection are uniquely identified.
- The correct samples are analyzed and are traceable to their records.
- Important sample characteristics are preserved.
- Samples are protected from loss or damage.
- Any alteration of samples (e.g., filtration, preservation, and dilution) is documented.

- A record of sample integrity is established.
- Legally traceable custody and possession records are maintained.

For this project, a sample is defined as being in an individual's custody if the following conditions occur:

- The sample is in that individual's actual physical possession.
- The sample is in that individual's view after being in their physical possession.
- The sample is in that individual's physical possession and then locked or otherwise sealed so that tampering would be evident.
- The sample is maintained in a secure area that is restricted to authorized personnel only.

General field custody procedures include the following:

- As few people as possible should handle samples.
- The field sampler is personally responsible for the care and custody of the samples collected until they are properly transferred.
- When transferring the samples, the individuals relinquishing and receiving the samples shall document the transfer by signing, dating, and writing the time of transfer on the COC form.
- The person responsible for delivering the samples to the laboratory or to the shipping carrier shall sign the COC form, retain a copy of the form, document the method of shipment, and send the original and second copy of the form with the samples.
- Custody seals shall be attached so that it is necessary to break the seal to open the shipping container. The person affixing the custody seal shall sign and date the seal.

Observe general documentation rules, including the use of ink. Make any changes to the COC form by drawing a single line through the incorrect material and initialing the markout. Put a line through and initial blank lines on the COC form.

Upon receiving the samples, the laboratory's representative shall do the following:

- Sign and keep copies of shipping documents.
- Sign the COC form and return the second copy to the project manager (may be included with the analysis results)
- Measure and document the temperature of the samples.
- Document the condition of the custody seals and of the samples.
- Notify the project manager if any breakage or improper preservation has occurred or if there is a discrepancy between the COC form, sample labels, and requested analyses.
- Provide copies of the above documentation to the project manager with the final laboratory data package.

6.0 REFERENCES

American Society for Testing and Materials (ASTM). D-4840-88, Standard Practice for Sampling Chain-of-Custody Procedures, 1995 Annual Book of ASTM Standards, Vol. 04.08.

Table 1 Analytes, Sample Containers, Preservation, and Holding Time Requirements for Water and Soil Samples

Analyte	Sampling Container	Preservation Method	Holding Time
Measured in Field			
pH, Electrical Conductivity (EC), Temperature	Temporary	Not required	Analyze as soon as possible after collection
Water Analyzed by Laboratory			
Major Ions and Metals	1 liter plastic	Add HNO_3 to pH < 2 Cool at 4° C	6 months
Gross alpha and beta	1 liter plastic	Add HNO_3 to pH < 2	6 months
Sulfate, Chloride	500 ml plastic	Cool at 4° C Unpreserved	28 days
TPH	2-40 ml VOA vials	Add HCl to <2, Cool at 4° C	14 days
Halogenated Volatile Organics	2-40 ml VOA vials	Add HCl to <2, Cool at 4° C	14 days
Soil Analyzed by Laboratory			
Major Ions, Metals, Sulfate, Chloride	Doubled 1 gal Zip-lock	Cool at 4° C	6 months
Gross alpha and beta	Doubled ½ gal Zip-lock	Not required	6 months
TPH	1 – 4 oz. Soil jar	Cool at 4° C	14 days
Halogenated Volatile Organics	1 – 4 oz. Soil jar	Cool at 4° C	14 days

STANDARD OPERATING PROCEDURE NO. 6

DATA VALIDATION

FOR
SOIL SAMPLING AND ANALYSIS WORK PLAN

STANDARD OPERATING PROCEDURE NO. 6
DATA VALIDATION
Version 0.0

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1.0 PURPOSE AND SCOPE

This section presents data validation procedures for activities conducted pursuant to the work plan and the QAPP. The QAPP serves to document the quality assurance requirements applicable to field sampling and laboratory analysis tasks and presents the requirements for performing, reviewing, and documenting activities that affect the quality of data. The Data Validation SOP presents the methods used to achieve the data quality objectives set forth in the QAPP. All field data collection and sampling activities conducted under this work plan will undergo the procedures specified in the Data Validation Plan. As specified in the EPA Order (EPA, 1999), the QAPP and related SOPs were prepared in accordance with the requirements provided in EPA QA/R-5 (EPA, 1998a) and EPA QA/G-5 (EPA, 1998b).

1.1 Standard Operating Procedures (SOPs)

As described in the QAPP, field data collection and sampling shall take place according to Standard Operating Procedures (SOPs) to ensure sample and data quality. All SOPs are presented in Appendix C of the work plan. Various types of samples and field data will be collected as part of this work plan. Listed below are the SOPs related to sample collection, handling, analysis, and decontamination that relate to this data validation SOP.

- SOP No. 1 Surface Water Sample Collection
- SOP No. 3 Soil Sampling
- SOP No. 5 Sample Handling, Documentation, and Analysis

1.2 Data Validation

This section presents the validation process that will take place to evaluate the quality of data collected pursuant to this work plan. The purpose of data validation is to assess the data quality, using information such as sample holding times and laboratory and field quality assurance data.

Inorganic data shall be validated in accordance with EPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review (EPA, 1994) for the following activities: (1) holding times, (2) blank reviews, (3) preparation blanks, (4) laboratory control samples, (5) laboratory duplicate samples, and (6) matrix spikes samples. The laboratory will provide a QC summary for review. Sections 1.2.1 through 1.2.4 present specific data validation procedures that will be performed.

After performing the data validation, some of the analytical data may fail to meet the acceptance criteria. Such data may be qualified using the following designations.

J -	Estimated	U -	Below Detection
UJ -	Estimated Below Detection	R -	Rejected (unusable)

The validation process will provide qualification of data based on the results of one or more of the evaluations discussed in the following sections.

1.2.1 Holding Times

Holding times for all analytes shall be compared to recommended holding times as presented in SOP No. 5. If holding times are exceeded, the results shall be qualified as J/estimated.

1.2.2 Duplicate Analyses

Duplicate water samples are collected in the field and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision; therefore, the results may have more variability than laboratory duplicates that measure only laboratory performance. A comparison of primary and duplicate samples shall be conducted to determine the variance or relative percent difference (RPD) between the concentration of each analyte.

$$RPD = [(P-D)x100]/[(P+D)/2]$$

where: P = primary concentration (mg/L)
D = duplicate concentration (mg/L).

For water samples, a target control limit of 20 percent for the RPD shall be used for primary and duplicate samples greater than or equal to five times the detection level. A target control limit of the detection level shall be used when either or both the primary and duplicate samples are less than five times the detection level.

If the target control limit for the RPD is exceeded, it shall be noted in narrative comments accompanying the data reports or data summary reports. As a possible indication of the source of the variance, the RPD values of associated laboratory duplicate analyses shall be checked. If it appears that the source of the variance was not due to the laboratory analysis, then field procedures shall be reviewed. If field procedures were a potential source of variance, it shall be noted in the applicable report(s).

1.2.3 Field Blank and Equipment Rinsate Analyses

If any analyte is detected in an equipment rinsate or field blank sample, the sample analysis results within a factor of two times the concentration found in the associated blank or equipment rinsate sample shall be qualified as below detection.

1.2.4 Laboratory Quality Control Reports

The results of the laboratory QA/QC testing will be presented in laboratory quality control reports. These reports shall include analysis results for matrix spike samples, laboratory blank and duplicate samples, and laboratory control samples, as appropriate. The reports shall be reviewed for each sample delivery group and the laboratory QA/QC results shall be checked to determine whether matrix effects are present, whether sample homogeneity is a concern, and to determine the overall precision for field samples. Laboratory blank and control samples shall provide assurances that the laboratory has not introduced contamination and that the laboratory is capable of accurately performing the analyses.

If it is apparent that there was a significant problem with the laboratory quality control that may affect the quality of the data, the problem will be corrected. The problem and the possible impacts to the data shall be discussed in data report(s), as appropriate.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1983. Methods for Chemical Analysis of Water and Wastes. EPA-600/4-79-020. Environmental Monitoring and Support Laboratory. Cincinnati, Ohio.

U.S. Environmental Protection Agency (EPA), 1994. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. EPA-540/R-94-013. February.

U.S. Environmental Protection Agency (EPA), 1998a. EPA Requirements for Quality Assurance Project Plans for Environmental Data Operation. QA/R-5. U.S. Environmental Protection Agency Quality Assurance Division. External Review Draft Final. October.

U.S. Environmental Protection Agency (EPA), 1998b. EPA Guidance for Quality Assurance Project. EPA QA/G-5. February.

U.S. Environmental Protection Agency (EPA), 1999. Order Requiring Monitoring, Testing, Analysis and Reporting. United States Environmental Protection Agency, Region VIII. RCRA Docket. Proceeding Under Section 3013 of the Resource Conservation and Recovery Act, 42 U.S.C. § 6934. Docket No.: RCRA-8-99-06. September.

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June 27, 2001

Ms. Janice Pearson
U.S. EPA
Region VIII
Office of Enforcement, Compliance,
and Environmental Justice
999 18th Street, Suite 500, 8ENF-T
Denver, Colorado 80202-2466

RE: Apex – Revised Soil Sampling and Analysis Workplan

Dear Ms. Pearson:

Enclosed you will find the above referenced workplan. It has been revised in accordance with our discussions with you in the June 7, 2001, meeting. You may call me at 208-769-4154 if you have questions.

Sincerely,

Gary R. Gamble
Gary R/Gamble
Manager of Idle Properties

Enclosures

Cc: John Galbavy, Esq. (HMC)
John Jacus, Esq. (DG&S)
Clint Strachan (SMI)